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ABSTRACT

The development of a CCMIT module began with visions of fascinating combinations of computer graphics, slides, tapes, films, student computer interaction, and many other potential tools to be utilized in geographical education. The selection of a subject, however, led to a rapid revision of the initial concepts. In addition, the methodology of module development soon established the need for a more detailed knowledge of the chosen subject. The steps which had appeared simple and straightforward became complex and time consuming. The emergence of an almost complete module permitted testing to begin, and this created a new set of complications. Attempting to draw conclusions on the basis of inadequate testing results yielded recommendations for the future. (Author/JEG)

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REFLECTIONS ON A COMPUTERIZED MULTI-MEDIA INSTRUCTIONAL TELEVISION MODULE

by

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REFLECTIONS ON A COMPUTERIZED MULTI-MEDIA INSTRUCTIONAL TELEVISION MODULE

by

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Abstract: The development of a COMIT module has involved a broad spectrum of experiences. Initially the concepts presented sparked visions of fascinating combinations of computer graphics, slides, tapes, films, student-computer interaction and many other potential "tools" to be utilized in geographical education. The selection of a subject however, lead to a rapid revision of initial concepts. In addition, the methodology of module development soon established the necessity for a much more detailed knowledge of the chosen subject. The steps which had appeared relatively simple and straightforward became complex and time consuming. Finally, the emergence of a reasonably complete module permitted testing to begin and the problem of testing to come to the fore. Attempting to draw conclusions on the basis of inadequate testing results yielded recommendations for the future.

Initial Concept

As originally presented, the objective of Computerized Multi-Media Instructional Television was to combine educational television with computer assisted instruction and to evaluate the educational capability of this marriage.

To a geographer with specializations in the fields of geomorphology and remote sensing, the potential was fascinating. Imagine being able to incorporate in one unified module such diverse but interrelated teaching components as colour movies (video tapes), colour slides, sequential images with appropriate annotation (letters, arrows, dashed lines, etc.), dynamic computer graphics (in which lines could be made to move across the screen, letters could be made to flash on and off to emphasize audio comments, and colours could be used to distinguish the various segments being discussed), a sonic pen (which could be used by the student to indicate his or her selection in response to a visual or spoken query) and audio commentary overall (discussion, explanation, or query). Visions of colour movies showing waves breaking on a beach at normal speed and then later slow motion, followed by graphics illustrating the way in which water particles moved in a "normal" wave, then

in a wave breaking on a beach, the whole backed by the sounds of breaking waves and a discussion of wave dynamics, and followed by a series of questions to evaluate the students' comprehension of the factors and concepts involved, and of an almost infinite number of similar possibilities, were generated. Enthusiasm ran high.

Module Development

Then the crucial question was posed; given the need to test this apparently unlimited potential system, what small segment of a course currently being given should be developed into a COMIT module?

From the many possibilities, a segment which seemed ideally suited to the technique (as discussed above), or a segment which formed a small, important, but difficult to grasp, part of the course, could be selected. Based on numerous factors, but primarily the difficulty experienced by students in understanding the concept and the consequent length of time spent on explaining it, the subject of parallax, as used in remote sensing, was chosen.

Parallax is defined as: "The apparent displacement of the position of a body with respect to a reference point or system, caused by a shift in the point of observation".

Initially, the approach taken in attempting to set up a module was, in essence, to translate the lecture format to the COMIT format. A considerable number of weeks later, weeks which involved pages and pages of writing, innumerable diagrams, and enlightening discussions with the COMIT advisors, a significant factor became evident; the "author" didn't know as much about parallax as he thought he did!

This somewhat less than earth-shaking discovery led to an intensive review of the literature on the subject. This in turn led to another discovery; many other authors of texts and reference works, were unable to explain the concept of parallax clearly and concisely, or in any event, had not bothered to do so in their works!

However, an acceptable explanation was eventually formulated and the problem of developing the module was again attacked.

The first approach involved a spot on the screen, a student, and his or her thumb. The student closed his left eye and held his thumb between his right eye and the screen such that it obscured the spot (Figure 1 a); then,

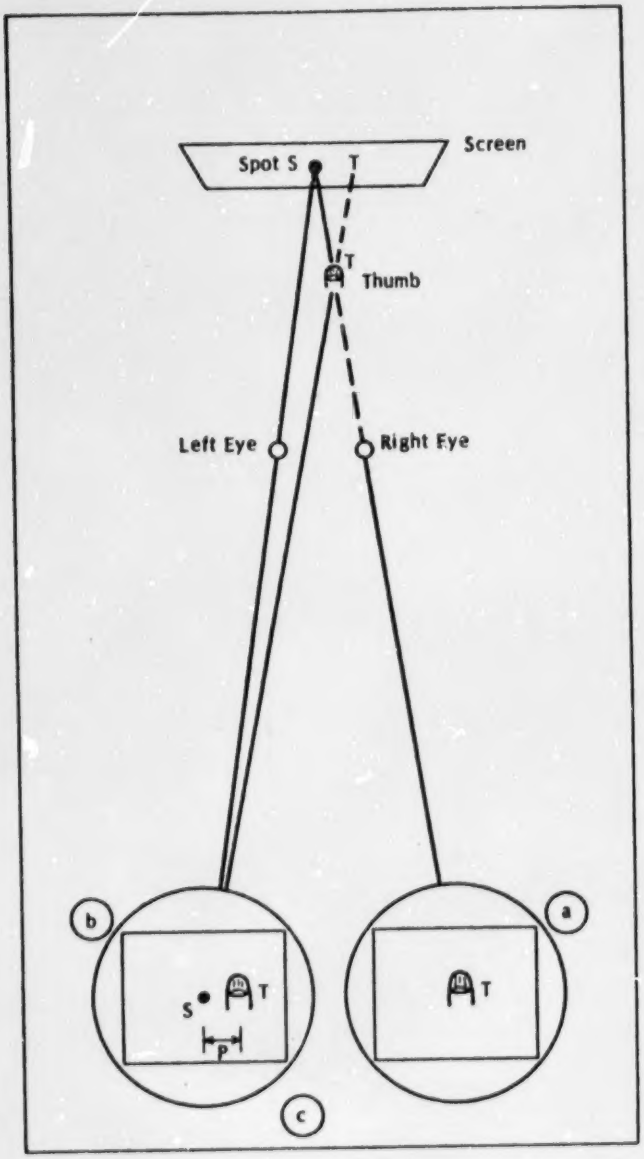


Figure 1 – a, b, & c

a. Right Eye View – Thumb,No Spot
b. Left Eye View – Spot,Thumb to the Right
c. S – T in i.b. is Parallax Displacement P

maintaining the same position (ie. not moving his head or his thumb), he closed his right eye and opened his left. At this point he could see the spot again and the thumb appeared to have shifted to the right of the spot (Figure 1 b). This apparent shift in the position of the thumb with respect to the reference point on the screen, when viewed from two different points in space (the right eye view and the left eye view), is called parallax displacement (Figure 1 c).

Problems of relating this simple example to the geometry of a sequential pair of air photos led to a number of revisions, and eventually, after a considerable length of time, to a somewhat different example involving a tree, a pole, and a car moving along a highway. This produced a sequential set of images which not only illustrated the apparent displacement of one body with respect to another and, in turn, both with respect to a reference point, but also permitted the utilization of a movie or video tape sequence which related the concept to a common every-day experience (Figures 2 a,b,c).

It was possible to display the geometry of this situation on the screen using slides; and also, using the dynamic computer graphics capability, to illustrate in a sequential format, the relationship between the angle of parallax (Figure 2) and the linear displacement of the features on the image, ie. linear parallax (P).

Throughout this developmental stage, it was necessary to keep in mind the necessity for interaction between the student and the "message" being presented on the terminal screen. A whole series of questions had to be devised (and answers provided) to lead the student to an understanding of the concept being presented. A number of incorrect answers had to be devised as well, (for each question) and a system of feed-back included such that, if a student selected the incorrect answer, he could request a review of the material, or a "hint", in order for him to satisfy the requirements before he proceeded to the next step.

Intermediate phases of the module involved measuring the apparent displacement (parallax) on the screen using scales incorporated in the image (Figure 3) and, in the final phases, the translation of this example to the aerial photograph and the geometry of parallax measurement as a method of determining heights of objects (Figure 4).

However, since this paper is not attempting to explain parallax, but rather to evaluate the COMIT approach to explaining parallax, no further

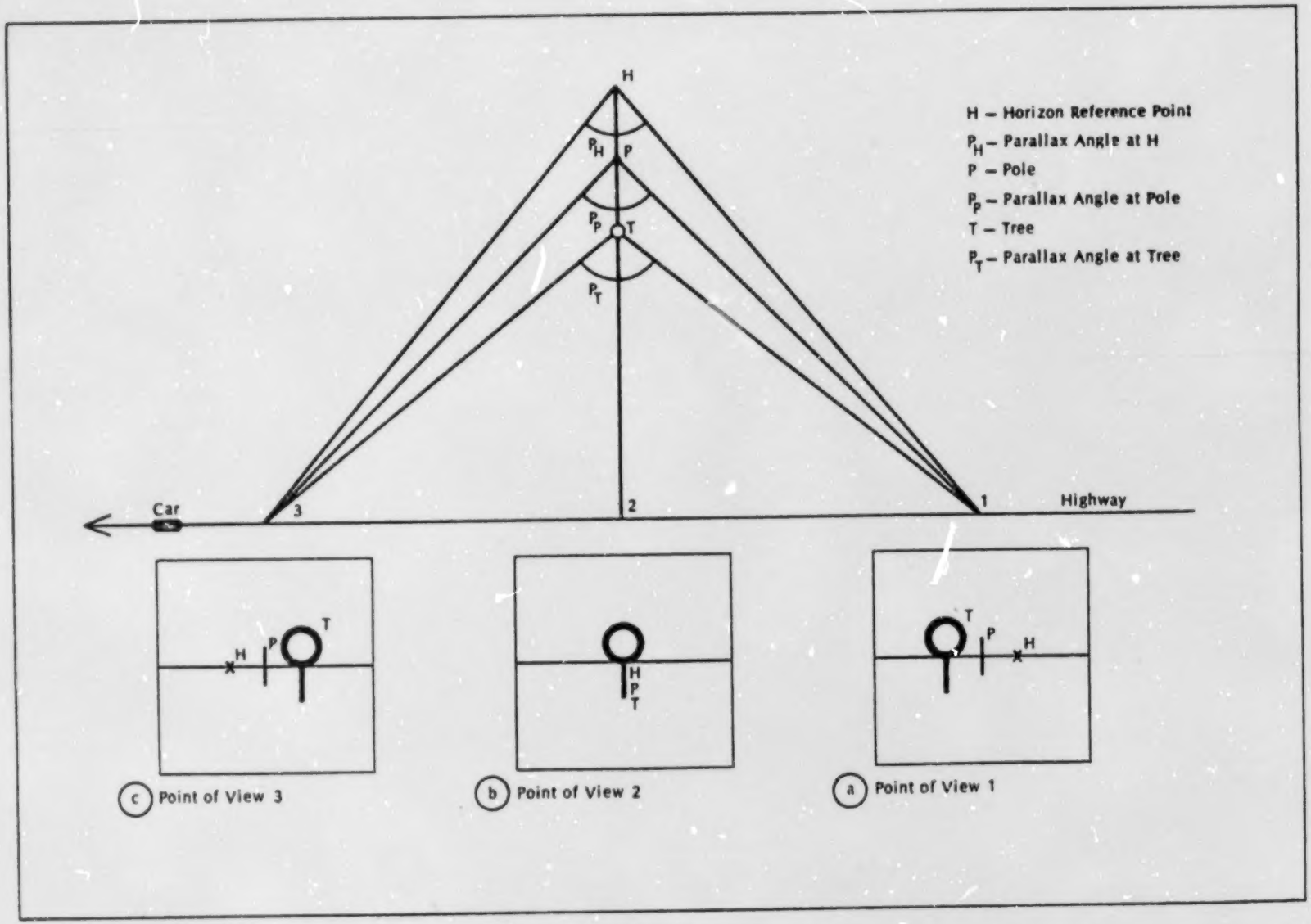

H
P_H
P
P_P
T
P_T
H – Horizon Reference Point
P_H – Parallax Angle at H
P – Pole
P_P – Parallax Angle at Pole
T – Tree
P_T – Parallax Angle at Tree
Car
3
2
1
Highway
H
P
T
H
P
T
T
P
H
c Point of View 3
b Point of View 2
a Point of View 1

Figure 2

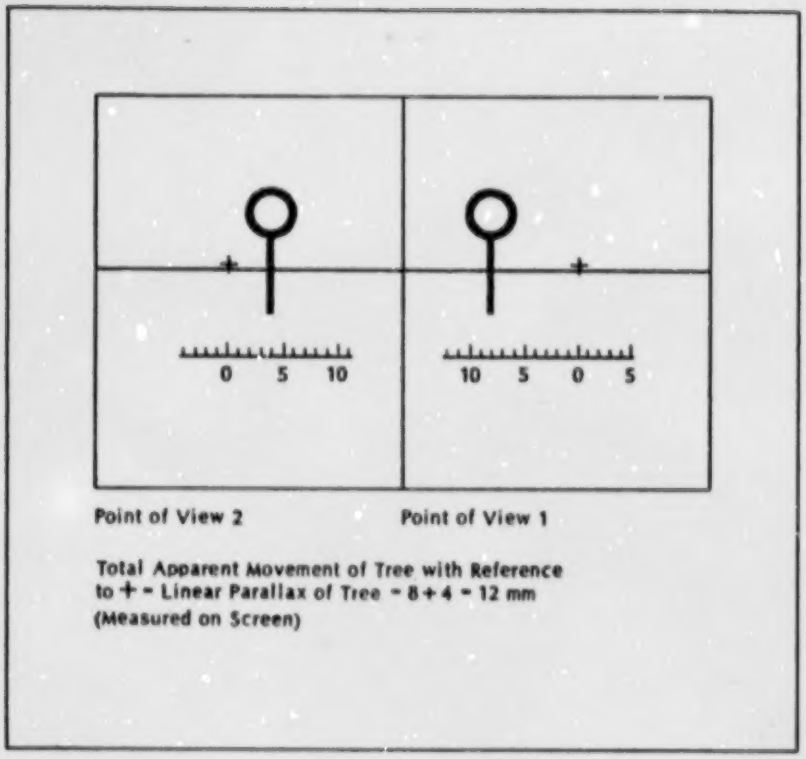
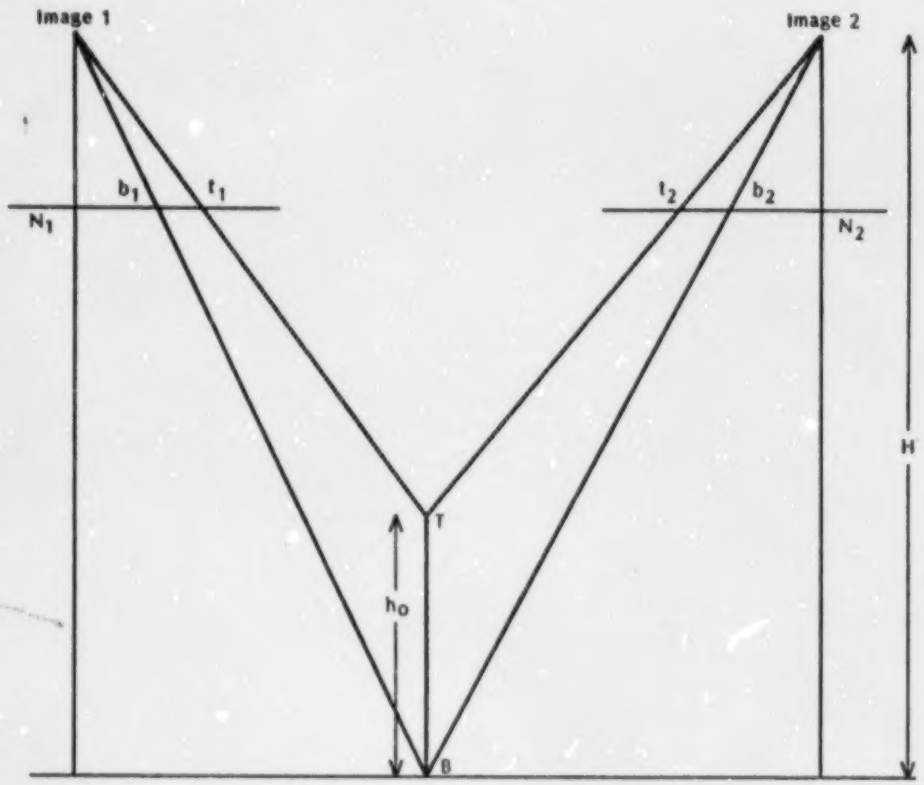

0 5 10
10 5 0 5
Point of View 2
Point of View 1
Total Apparent Movement of Tree with Reference to + = Linear Parallax of Tree = 8 + 4 = 12 mm
(Measured on Screen)

Figure 3



Parallax of Top of Pole = $N_1 t_1 + N_2 t_2$

Parallax of Bottom of Pole = $N_1 b_1 + N_2 b_2$ = Absolute Parallax P

Difference in Parallax Between Top and Bottom of Pole = dP

$= (N_1 t_1 + N_2 t_2) - (N_1 b_1 + N_2 b_2)$

$= b_1 t_1 + b_2 t_2$

$$h_o = \frac{H \times dP}{P + dP}$$

h_o = Height of Object

H = Flying Height

P = Absolute Parallax Base of Object

dP = Difference in Parallax

Figure 4

discussion of the actual module steps will be presented.

Having developed the module, the next step was to test it on the members of a class who were responsible for the concepts involved. At this point, one of the major disadvantages became apparent. The author, who at this point at least, should be assumed to know the answers, ran through the completed module on the terminal and determined that the time required was approximately 2½ hours. This was partly due to the fact that it was necessary to use a loose-leaf binder containing all the illustrations and diagrams instead of having them on the screen as previously proposed. This discrepancy or problem was in part the result of the author being on sabbatical during this phase of the programme.

The time required to complete the module when combined with a class of 120, obviously involved a major logistics problem; not only in terms of computer time itself, but also in terms of scheduling access to the limited number of terminals available. As a result, it was decided to use a small volunteer class sample and have them arrange their own scheduling. This proved to be another error. By the time the course had reached a stage involving the use of the concept, it was determined that only a few of the students had actually made appointments and worked through the module. The resulting comments were of minimal assistance in evaluating the system's capability.

This leads to some conclusions with respect to Computerized Multi-Media Instructional Television as a method of teaching a concept.

Conclusions

First, it does not appear to be a system which can be utilized to teach small components of a course, involving large numbers of students. Even assuming a relatively large number of terminals and access to these terminals over extensive periods of time during a normal day, the computer time required and the problems of scheduling the use of the terminals would be excessive.

Second, it is a system which demands a great many hours of input on the part of the author in order to develop a relatively simple module. This assumes an even greater number of hours of input on the part of an assistant, to programme the computer and handle the technical aspects, especially if video tapes, slides, audio tapes and many of the other elements which provide such a fascinating potential, are utilized.

Third, an author, or would-be author, should have or acquire a good working knowledge of computers and computer programming. It is difficult to foresee problems involving question format, answer format, graphic development, video, audio, and slide inclusion, etc., without any background knowledge in the field.

Fourth, unless experienced in COMIT module development, it would be advisable for an author to produce one or two trial modules before attempting a final effort. Familiarization with the problems associated with module development obtained in this trial period would permit the author to save a great deal of time in selecting and planning segments of his course to be presented in module form.

Fifth, the author should be fully familiar with the course segment or concept to be developed as a module. If the author can combine this capability with those discussed in three and four above, development of COMIT modules should not be too difficult.

Sixth, the nature of the subject matter has a great bearing on the use, development and effectiveness of the module format. Very difficult concepts requiring active faculty-student dialogue would not appear to be suitable in this context.

Seventh, in order to evaluate the effectiveness of a module, a statistically valid class sample should be selected, together with a control group subject to the standard method, and the two groups upon completion of the course segment involved should write an identical test. In addition, time expended by the students in the two methods should be taken into consideration. Finally, the opportunity for the one group to re-run the module if details of the concept were not clear, should be taken into account.

Eighth, if an author were to plan on using some, or all, of the various audio/visual capabilities of the system, knowledge of some of the basics of television programming such as story-board preparation, scenario writing, video "tricks", etc., would seem to be advisable.

Future

Most of the potential, which fascinated this author when the programme was first discussed, was not realized in the development of the module discussed here. The capabilities are still there, but it will require a different programme to make effective use of them. In this context, a multi-

unit module designed to present a complete segment of a course would seem not only feasible, but also desirable. In its initial implementation, it would not have the one-to-one, student/terminal interaction, but would be designed to complement rather than supplement a faculty member, in a classroom situation. However, individual units, making up the larger module, could be utilized, with appropriate visual or audio programmes, to provide the students with a very effective review facility (using a Comit-type terminal).

The above format could be developed for a full course, thus removing the repetitive aspect of a professor's programme and allowing him or her much more time for preparation, discussion, and interaction with the class - regardless of size. The length of each unit would be determined by the proportion of the lecture period assigned for discussion.

Finally, this type of module format could easily be included in off-campus (remote lecture theatre), in-home computer terminal, or conventional television/telephone, educational programmes.